MIRION TECHNOLOGIES Radiation Monitoring Systems Division

Radiation. **Safety.**

Neutron Flux and Reactor Gamma Monitoring for a New Research, Training and Isotope Production Nuclear Facility

Dr. Ewald LIEBHART, Isabelle LAURENT

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Table of contents

MIRION TECHNOLOGIES

I. Requirements

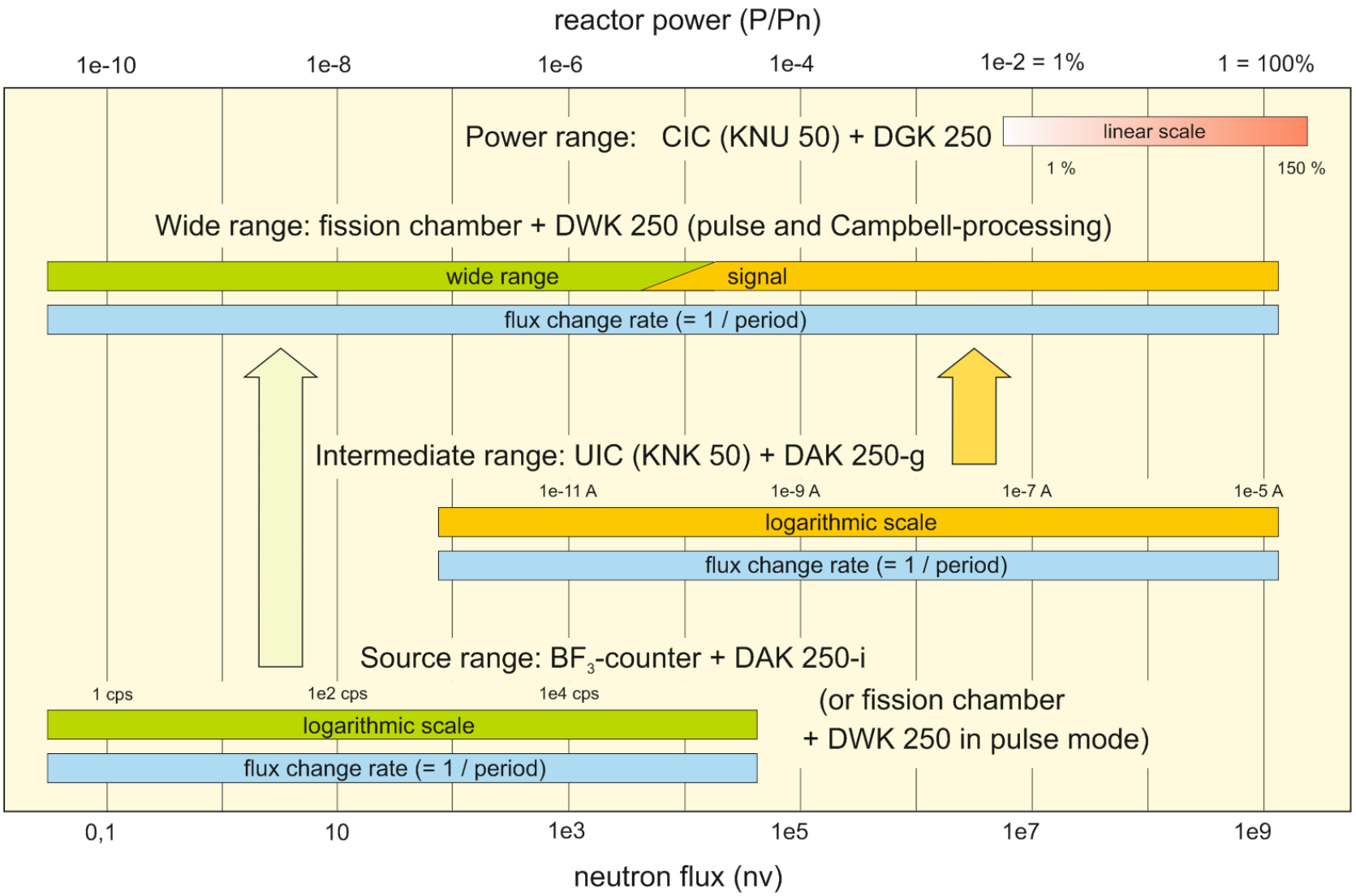
Key Customer Requirements:

- Turn-key project/system including installation and commissioning support
- User friendly HMI
- Eliminate signal noise issues
- Short electronic response times
- Qualification to international regulatory standards (USNRC RGs)
- Easy to calibrate and to maintain
- Facilitate future upgrades (RR 5 -> 10 MW)
- Technical compliance
- Platform compliance – dimensions/weight
- Type and number of signals
- Tight coordination between customer and supplier

II. Digital neutron flux monitoring system proTK™

Digital Neutron Flux Channels proTK™	
DAK 250	**Source range and intermediate range monitoring** With pulse processing or DC signal processing, reactimeter optional also used e.g. for steam generator leakage monitoring (N16)
DWK 250	**Wide range monitoring** With combined pulse processing and Campbell signal processing for in-core & out-core fission chambers
DGK 250	**Power range monitoring** For the PWR with 1 or 2 signal paths for neutron ionization chambers
DLK 250	**Flux distribution monitoring** For 3 or 6 SPN detectors with background compensation, calibration and noise reduction
DSK 250/ DMK 250	**Local & average power range monitoring** For the BWR with average flux and flow related flux, including stability monitoring

II. proTK™ - range coverage



III. Neutron Measurement System (NMS) - Features

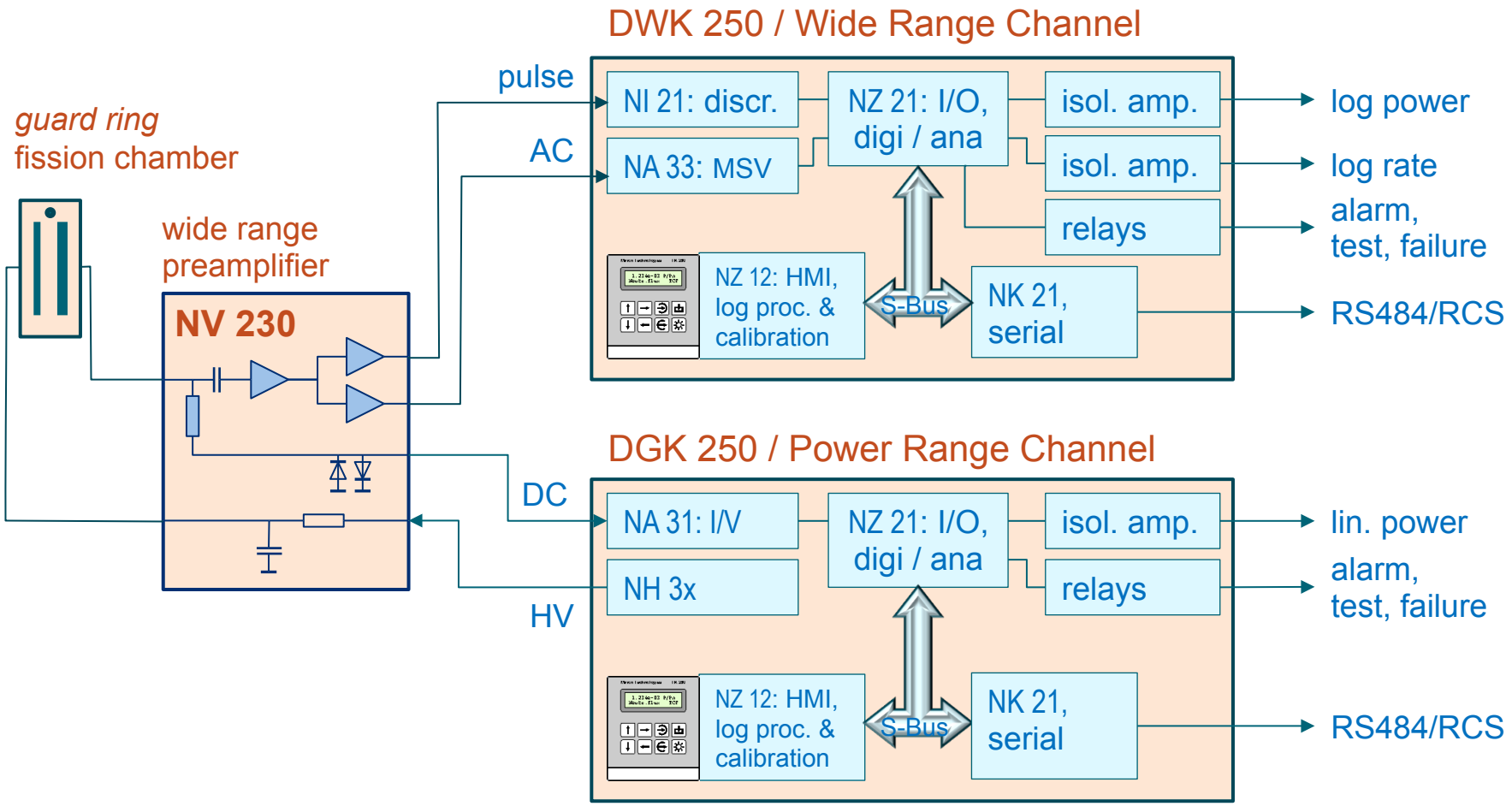
For this research reactor, the Neutron Measurement System (NMS) should:

- Measure the neutron flux via detector assemblies inside the pool
- Measure the neutron flux from start-up of the reactor to full power in a harsh environment, with just one fission chamber per system (monitor)
- Provide analog output signals: two neutron power levels (linear power, log. power) and log. rate
- Provide binary output signals: threshold and failure alarms
- Be qualified as Class 1E equipment

Solution :

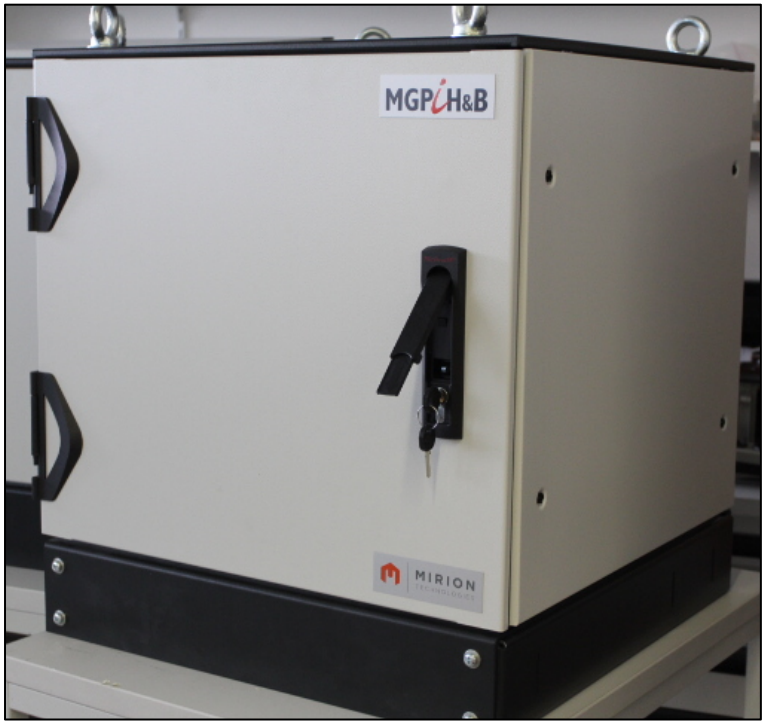
- A combination of the digital wide range channel DWK 250 and the digital power range channel DGK 250 proved most suitable.
- The configuration was completed with the custom designed detector assembly comprising a wide range fission chamber.

III. NMS – Signal path



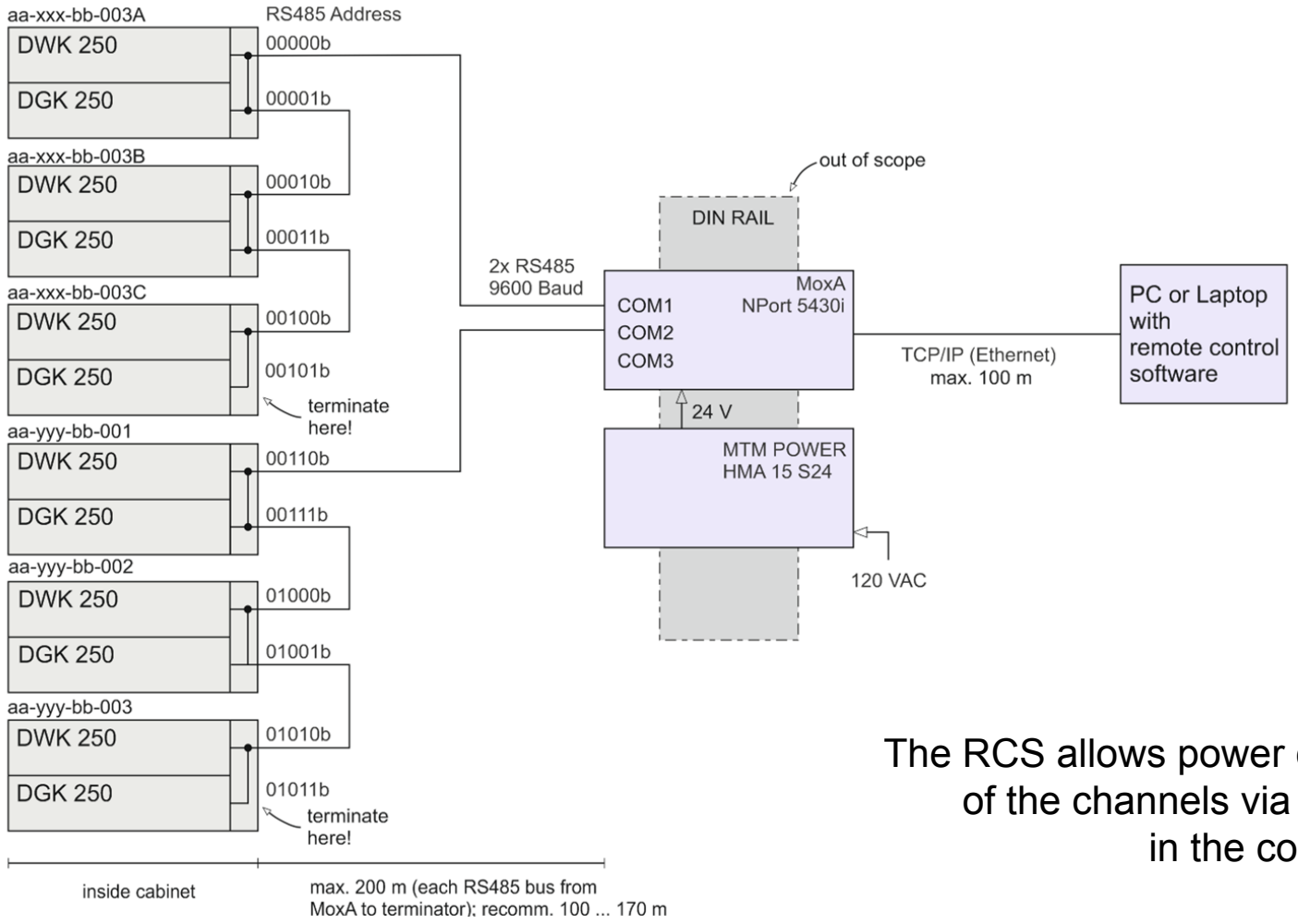
III. NMS – Mounting & Enclosure

Front view of the NMS signal processing cabinet with the combined wide range and power range channels DWK 250 (top rack) and DGK 250 (bottom rack), respectively.



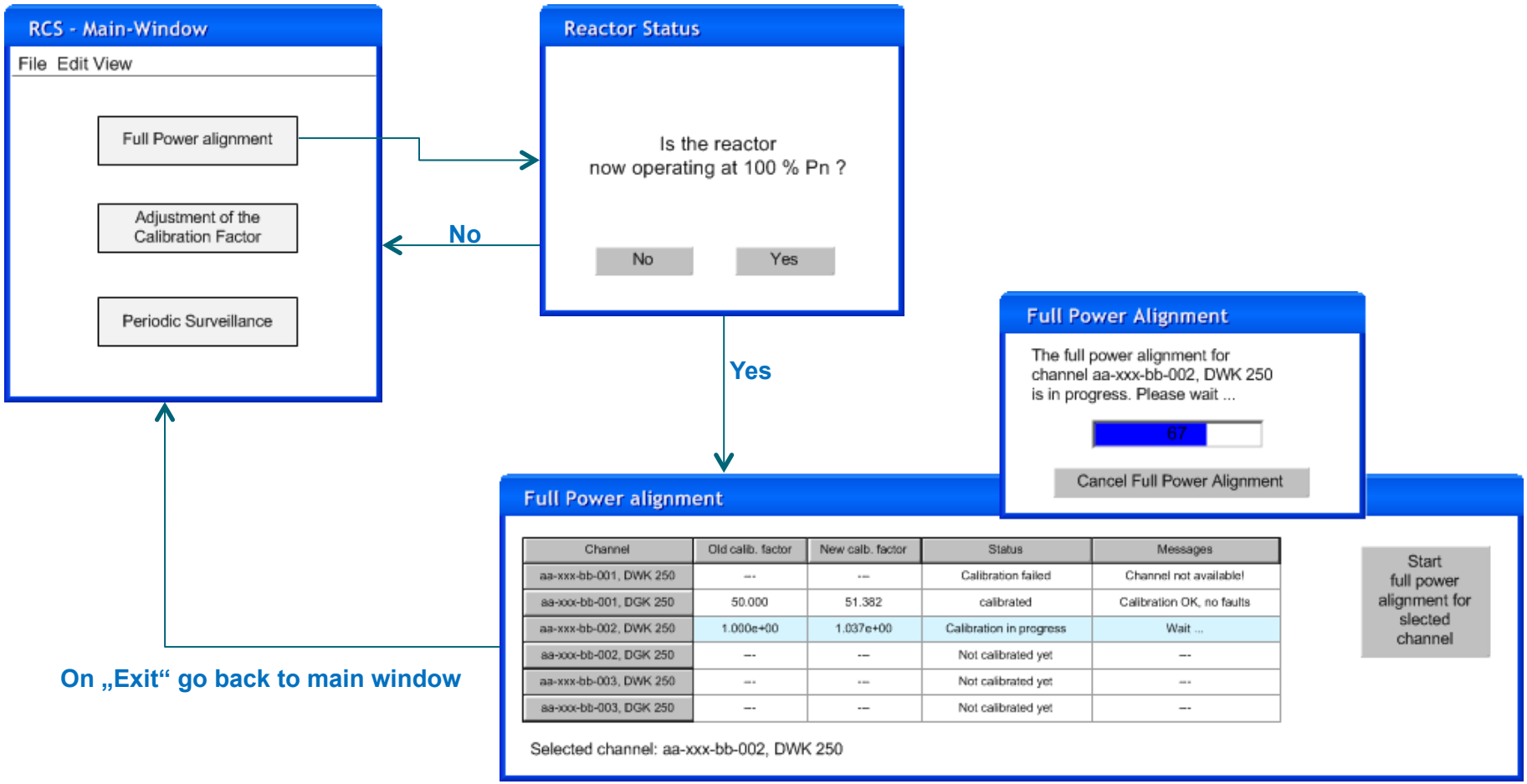
Processing units for both systems, NMS and RGMS, are mounted each in a Heavy Duty Seismic cabinets.

IV. Remote Control System (RCS) – Functional diagram



The RCS allows power calibration of the channels via a terminal in the control room

IV. RCS – Example of the Graphical User Interface (GUI)



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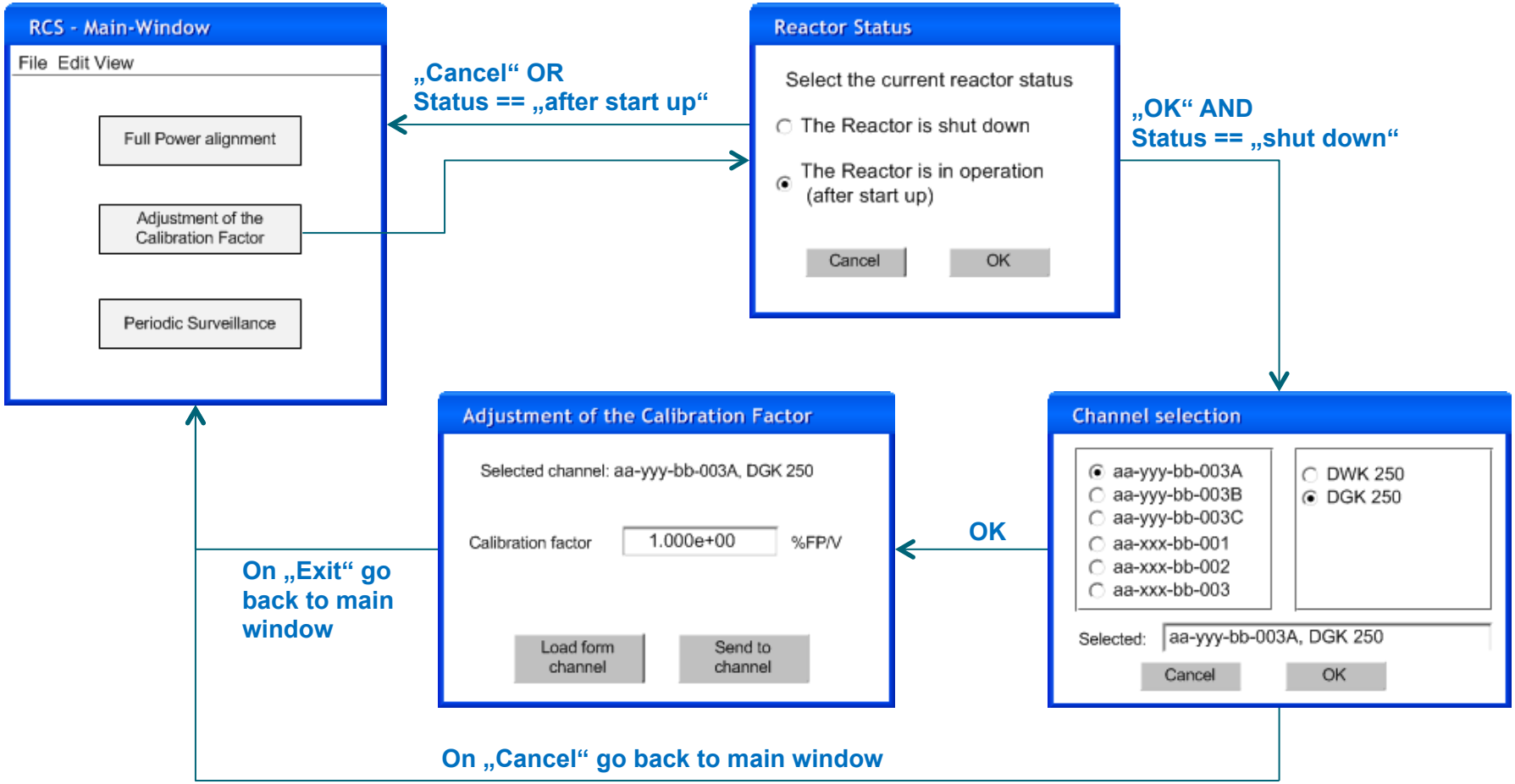

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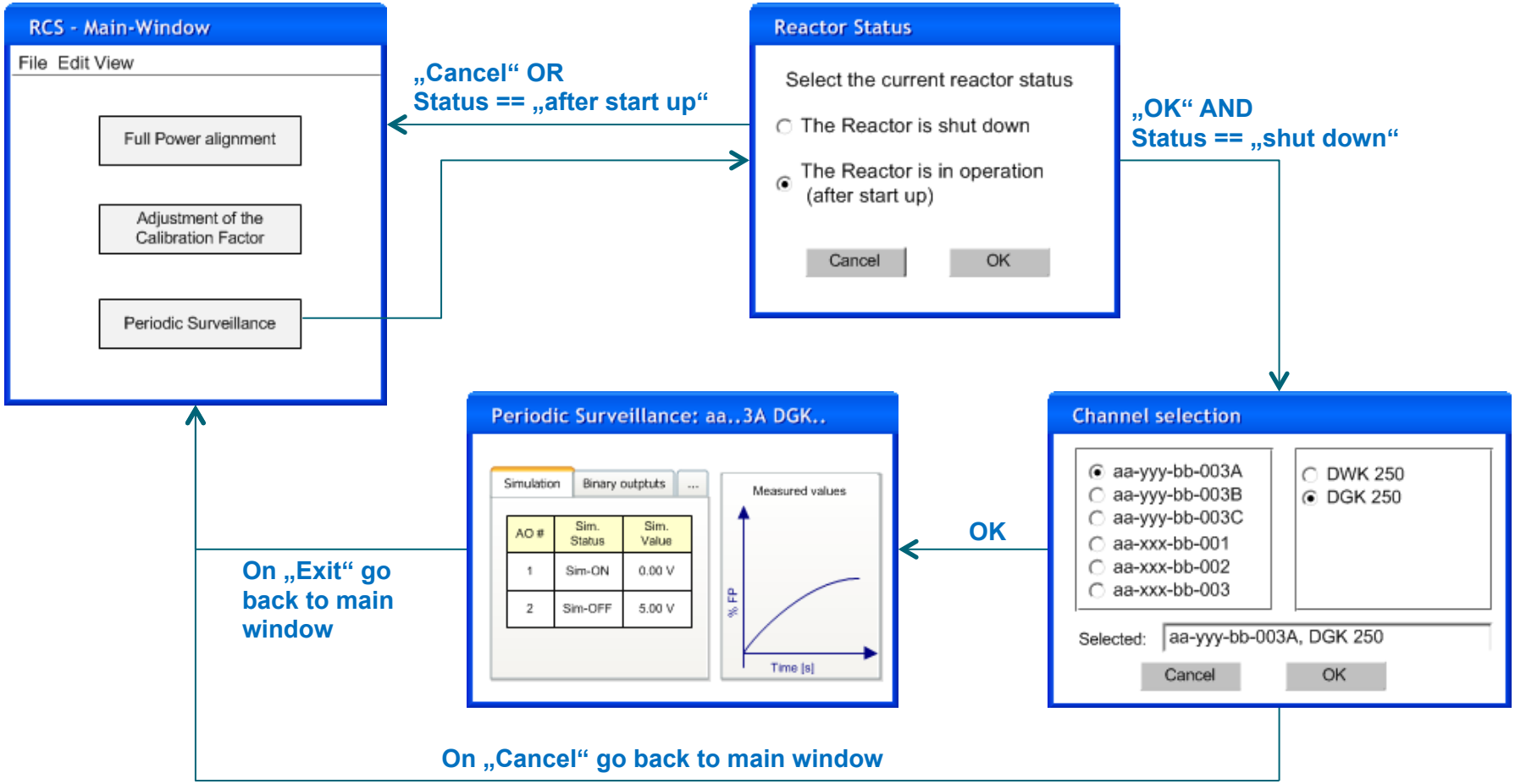


V. Reactor Gamma Monitoring System (RGMS) - Features

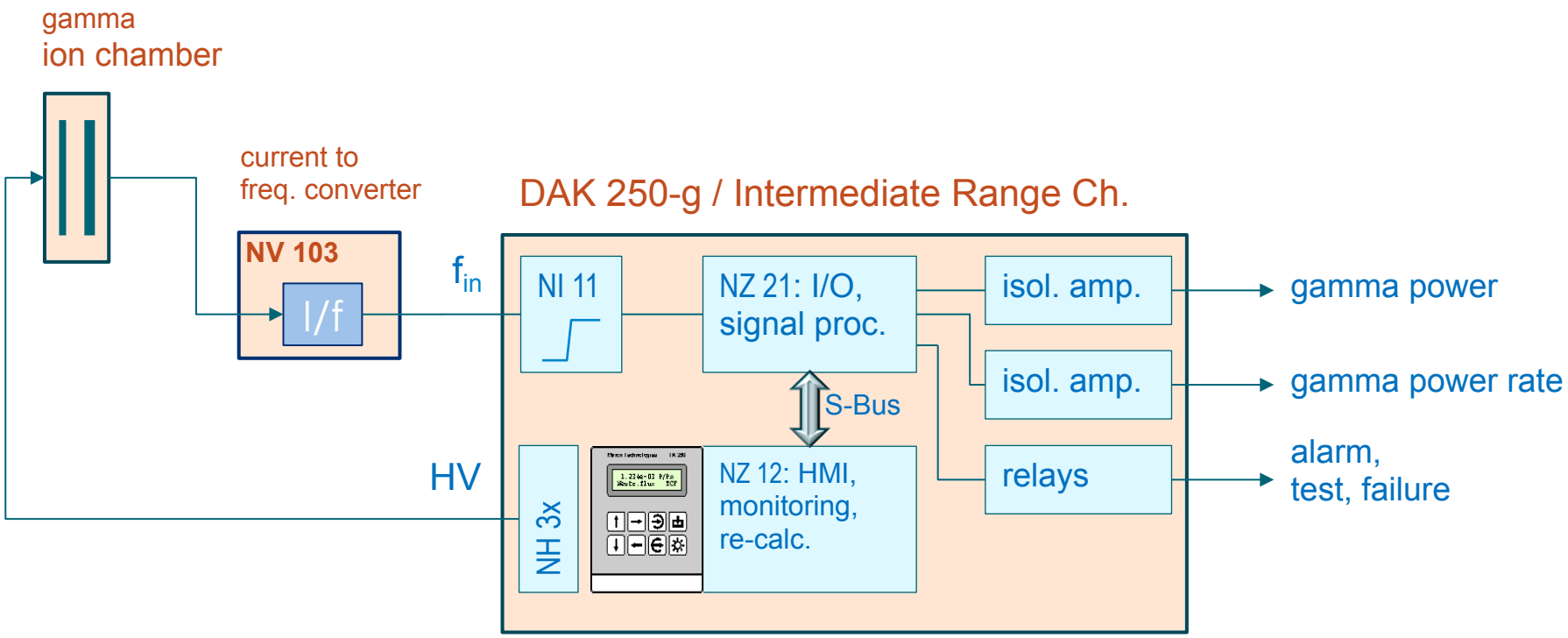
The Reactor Gamma Monitoring System should:

- Measure gamma radiation level around the heavy water reflector tank in the reactor pool
- Provide analog output signals: gamma power and change rate of the gamma power
- Provide binary output signals: threshold and failure alarms

Solution:

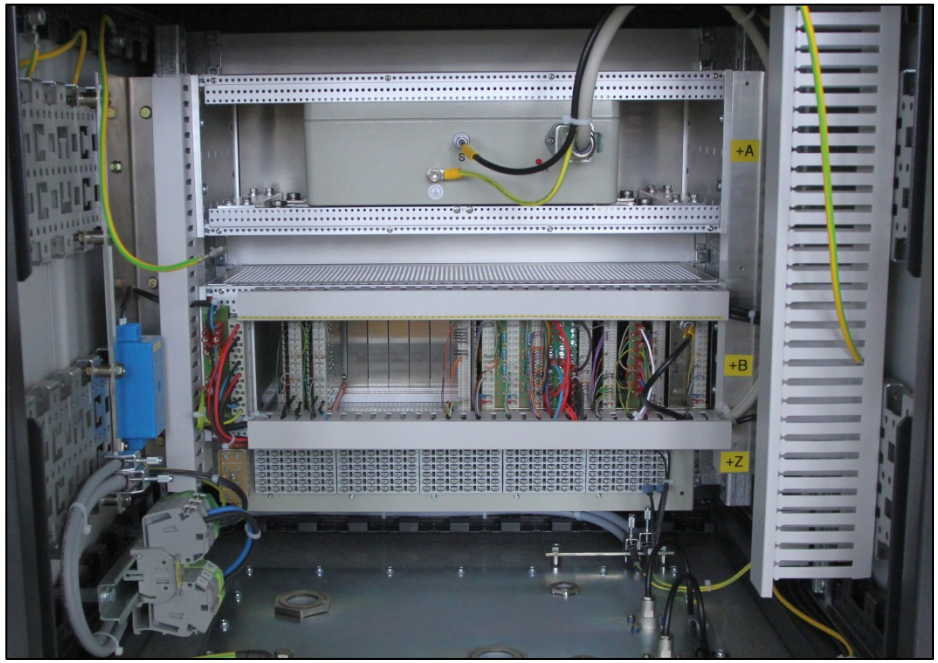
- A gamma ionization chamber installed in a water tight assembly
- The signal processing is performed by the digital intermediate range channel model DAK 250-g.

V. RGMS – Signal path



V. RGMS – Mounting & Enclosure

Rear view of the RGMS cabinet.
Top rack: current-to-frequency converter
Bottom rack: intermediate range channel
DAK 250-g



Front view of the RGMS cabinet.

VI. Key benefits of solution

The designed solutions provide the following benefits:

- Delivery of a turn-key solution with a user friendly and easy to manipulate interface due to the digital processing
- Software-based, modular design allows both systems:
  - **Ease of calibration and maintenance**
  - **Capacity for easy future upgrades if desired by the owner/user**
- The choice and design of system components (pre-amps, cables, connectors, matching impedance of interfaces, grounding concept) minimizes noise on the signals.
- Full qualification of both systems is performed in accordance with international standards

Questions?

Ask us!
Please visit our booth,
our staff is anxious to help!

Dr. Ewald LIEBHART
Director R&D

E-Mail: **eliebhart@mirion.com**
Tel: +49 (0)89 51513-112
Mobile: +49 (0)172 8686 079

Isabelle LAURENT
Project Manager

E-Mail: **ilaurent@mirion.com**
Tel: +49 (0)89 51513-181
Mobile: +49 (0)152 09063978

Mirion Technologies (MGPI H&B) GmbH
Landsberger Str. 328a, 80687 Munich, Germany

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